CLAIMS

1. A broad area field electron emitter comprising a plurality of emitter cells formed in a layered structure, each cell comprising a hole at the base of which a field electron emission material is disposed:

wherein said layered structure comprises:

an emitter layer having a substrate provided with an electrically conductive surface and said field electron emission material disposed on said surface;

a gate electrode spaced from said emitter layer; and

dielectric material disposed between said emitter layer and said gate electrode:

and wherein:

a first region of dielectric material contacts said emitter layer;

a second region of dielectric material contacts said gate electrode; and

means is provided for reducing cell-wall charge between said first and second regions.

2. A broad area field electron emitter according to claim 1, wherein said means for reducing cell-wall charge comprises an increase in the diameter of each cell from said first region to said second region.

3. A broad area field electron emitter according to claim 2, wherein the side walls of each cell taper linearly from said first region to said second region.

4. A broad area field electron emitter according to claim 2, wherein the side walls of each cell taper in a curved shape from said first region to said second region.

5. A broad area field electron emitter according to any of the preceding claims, wherein said means for reducing cell-wall charge comprises a current-leakage path provided within said dielectric material.

6. A broad area field electron emitter according to claim 5, wherein said dielectric material or further material is selected from the group comprising chromium sesquioxide and silica with low concentrations of carbon or iron oxide.

7. A broad area field electron emitter according to any of the preceding claims, wherein said means for reducing cell-wall charge comprises a low secondary electron yield material with first cross-over potential less than the maximum emitter layer to gate voltage of the emitter, said low secondary electron yield material comprising said dielectric material or an insulator material provided on the side walls of each cell.

8. A broad area field electron emitter according to claim 7, wherein said dielectric material or further material is selected from the group comprising Cr_2O_3, SiN, a-Si, SiC, carbon and implanted carbon.

9. A broad area field electron emitter according to any of the preceding claims, wherein said means for reducing cell-wall charge comprises a layered configuration within said dielectric material, to provide focusing of electrons emitted by said field electron emission material.

10. A broad area field electron emitter according to claim 9, wherein said layered configuration comprises a thin focus electrode between layers of said dielectric material.

11. A broad area field electron emitter according to claim 10, wherein said thin focus electrode is of metal.

12. A broad area field electron emitter according to claim 11, wherein said metal comprises chromium.

13. A broad area field electron emitter according to claim 10, 11 or 12, wherein said thin focus electrode has a thickness of less than 1 micron.

14. A broad area field electron emitter according to claim 9, wherein said layered configuration comprises layers of dielectric material of differing dielectric constant.

15. A broad area field electron emitter according to claim 14, wherein said layers of dielectric material of differing dielectric constant comprise a layer of lower dielectric constant which has a thickness in the range 10% to 80% of the thickness of the layered configuration of said dielectric material.

16. A broad area field electron emitter according to claim 14 or 15, wherein said layers of dielectric material have dielectric constants that differ in a ratio of at least 3:2.

17. A broad area field electron emitter according to claim 16, wherein said layers of dielectric material have dielectric constants that differ in a ratio of at least 4:1.

18. A broad area field electron emitter according to any of the preceding claims, wherein said dielectric material includes a layer of material that is porous relative to the rest of the dielectric material, to trap electrons.

19. A broad area field electron emitter according to claim 18, wherein said porous material has a porosity of approximately 50%.

20. A broad area field electron emitter substantially as hereinbefore described with reference to the accompanying drawings.

21. A field electron emission device comprising a broad area field electron emitter according to any of the preceding claims, and means for subjecting said emitter to an electric field in order to cause said emitter to emit electrons.

22. A field electron emission device according to claim 21, comprising a substrate with an array of patches of said broad area field electron emitter.

23. A field electron emission device according to claim 21 or 22, comprising a plasma reactor, corona discharge device, silent discharge device, ozoniser, an electron source, electron gun, electron device, x-ray tube, vacuum gauge, gas filled device or ion thruster.

24. A field electron emission device according to claim 21, 22 or 23, wherein the broad area field electron emitter supplies the total current for operation of the device.

25. A field electron emission device according to claim 21, 22, 23 or 24, wherein the broad area field electron emitter supplies a starting, triggering or priming current for the device.

26. A field electron emission device according to any of claims 21 to 25, comprising a display device.

27. A field electron emission device according to any of claims 21 to 25, comprising a lamp.

28. A field electron emission device according to claim 27, wherein said lamp is substantially flat.

29. A field electron emission device according to any of claims 21 to 28, wherein said broad area field electron emitter is connected to an electric driving means via a ballast resistor to limit current.

30. A field electron emission device according to claims 22 and 29, wherein said ballast resistor is applied as a resistive pad under each said emitting patch or in the form of a laterally conducting layer to segments of the emitting region.

31. A field electron emission device according to any of claims 21 to 30, wherein said broad area field electron emitter and/or a phosphor are coated upon one or more one-dimensional array of conductive tracks which are arranged to be addressed by electronic driving means so as to produce a scanning illuminated line.

32. A field electron emission device according to claim 31, including said electronic driving means.

33. A field electron emission device according to any of claims 21 to 32, wherein said broad area field electron emitter is disposed in an environment which is gaseous, liquid, solid, or a vacuum.

34. A field electron emission device according to any of claims 21 to 33, comprising a cathode which is optically translucent and is so arranged in relation to an anode that electrons emitted from the cathode impinge upon the anode to

cause electro-luminescence at the anode, which electro-luminescence is visible through the optically translucent cathode.

35. A field electron emission device substantially as hereinbefore described with reference to the accompanying drawings.